FM front-end IC | TDA1574

GENERAL DESCRIPTION

The TDA1574 is a monolithic integrated FM tuner circuit designed for use in the r.f./i.f. section of car radios and home-receivers. The circuit comprises a mixer, oscillator and a linear i.f. amplifier for signal processing, plus the following additional features.

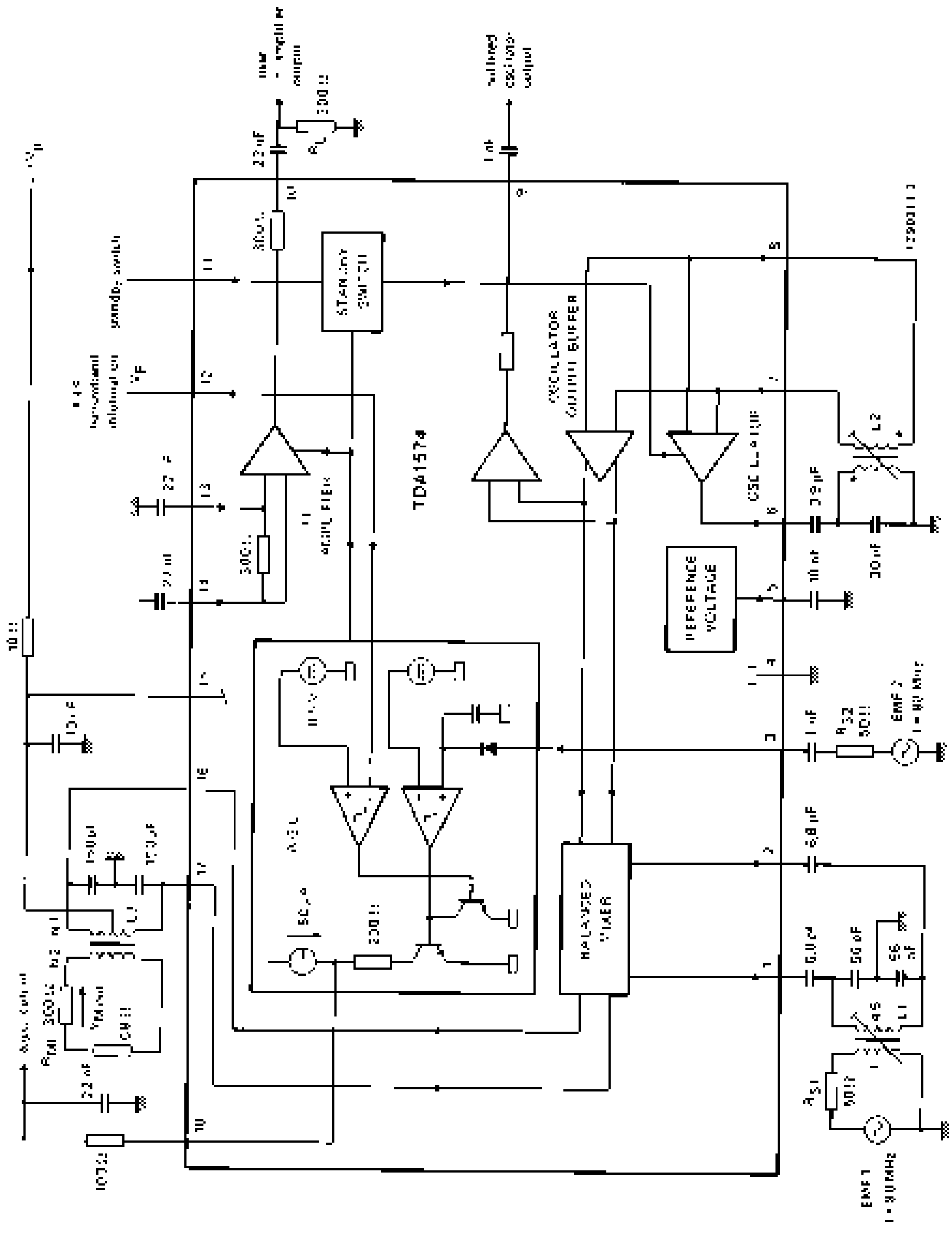
Features

- Keyed automatic gain control (a.g.c.)
- Regulated reference voltage
- Buffered oscillator output
- Electronic standby switch
- Internal buffered mixer driving

QUICK REFERENCE DATA

Supply voltage range (pin 15)	V_P		7 to 16	V
Mixer input bias voltage (pins 1 and 2)	$V_{1,2-4}$	typ.	1	V
noise figure	NF	typ.	9	dB
Oscillator output voltage (pin 6)	V_{6-4}	typ.	2	V
output admittance at pin 6 for f = 108,7 MHz	Y22	typ.	1,5 + j2	mS
Oscillator output buffer				
D.C. output voltage (pin 9)	V_{9-4}	typ.	6	V
Total harmonic distortion	THD	typ.	−15	dBC
Linear i.f. amplifier output voltage (pin 10)	V_{10-4}	typ.	4,5	V
noise figure at R_S = 300 Ω	NF	typ.	6,5	dB
Keyed a.g.c. output voltage range (pin 18)	V_{18-4}		+ 0,5 to V_P−0,3	V

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Coil data

L1 TOKO MC 108 514HNE 150014514, L = 0,078 µH

L2 TOKO MC 111, E516HNS 200057, L = 0,08 µH

L3 TOKO coil set 7P, N1 = 5,5 + 5,5 turns, N2 = 4 turns

Fig. 1 Block diagram and test circuit.

FUNCTIONAL DESCRIPTION

Mixer

The mixer circuit is a double balanced multiplier with a preamplifier (common base input) to obtain a large signal handling range and a low oscillator radiation.

Oscillator

The oscillator circuit is an amplifier with a differential input. Voltage regulation is achieved by utilizing the symmetrical tanh transfer-function to obtain low order 2nd harmonics.

Linear IF amplifier

The IF amplifier is a one stage, differential input, wideband amplifier with an output buffer.

Keyed AGC

The AGC processor combines narrow- and wideband information via an RF level detector, a comparator and an ANDing stage. The level dependent, current sinking output has an active load, which sets the AGC threshold.
The AGC function can either be controlled by a combination of wideband and narrowband information (keyed AGC), or by a wideband information only, or by narrowband information only. If only narrowband AGC is wanted pin 3 should be connected to pin 5. If only wideband AGC is wanted pin 12 should be connected to pin 13.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 15)	$V_P = V_{15\text{-}4}$	max.	18	V
Mixer output voltage (pins 16 and 17)	$V_{16,\ 17\text{-}4}$	max.	35	V
Standby switch input voltage (pin 11)	$V_{11\text{-}4}$	max.	23	V
Reference voltage (pin 5)	$V_{5\text{-}4}$	max.	7	V
Field strength input voltage (pin 12)	$V_{12\text{-}4}$	max.	7	V
Total power dissipation	P_{tot}	max.	800	mW
Storage temperature range	T_{stg}	−55 to +	150	°C
Operating ambient temperature range	T_{amb}	−40 to	+ 85	°C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j\text{-}amb}$	=	80	K/W

Note

All pins are short-circuit protected to ground.

CHARACTERISTICS

$V_P = V_{15\text{-}4} = 8{,}5$ V; $T_{amb} = 25\ ^oC$; measured in test circuit Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 15)					
Supply voltage	$V_P = V_{15\text{-}4}$	7	–	16	V
Supply current (except mixer)	$I_P = I_{15}$	16	23	30	mA
Reference voltage (pin 5)	$V_{5\text{-}4}$	3,9	4,1	4,4	V
Mixer					
D.C. characteristics					
Input bias voltage (pins 1 and 2)	$V_{1,2\text{-}4}$	–	1	–	V
Output voltage (pins 16 and 17)	$V_{16,17\text{-}4}$	4	–	35	V
Output current (pin 16 + pin 17)	$I_{16} + I_{17}$	–	4,0	–	mA
A.C. characteristics (f_i = 98 MHz)					
Noise figure	NF	–	9	–	dB
Noise figure including transforming network	NF	–	11	–	dB
3rd order intercept point	$EMF1_{IP3}$	–	115	–	dBμV
Conversion power gain					
$10 \log \frac{4\ (V_{M(out)}\ 10{,}7\ MHz)^2}{(EMF1\ 98\ MHz)^2} \times \frac{R_{S1}}{R_{ML}}$	G_P	–	14	–	dB
Input resistance (pins 1 and 2)	$R_{1,2\text{-}4}$	–	14	–	Ω
Output capacitance (pins 16 and 17)	$C_{16,17}$	–	13	–	pF
Oscillator					
D.C. characteristics					
Input voltage (pins 7 and 8)	$V_{7,8\text{-}4}$	–	1,3	–	V
Output voltage (pin 6)	$V_{6\text{-}4}$	–	2	–	V
A.C. characteristics (f_{osc} = 108,7 MHz)					
Residual FM (Bandwidth 300 Hz to 15 kHz); de-emphasis = 50 μs	Δf	–	2,2	–	Hz

parameter	symbol	min.	typ.	max.	unit
Linear i.f. amplifier					
D.C. characteristics					
Input bias voltage (pin 13)	$V_{13\text{-}4}$	–	1,2	–	V
Output voltage (pin 10)	$V_{10\text{-}4}$	–	4,5	–	V
A.C. characteristics (f_i = 10,7 MHz)					
Input impedance					
	$R_{14\text{-}13}$	240	300	360	Ω
	$C_{14\text{-}13}$	–	13	–	pF
Output impedance					
	$R_{10\text{-}4}$	240	300	360	Ω
	$C_{10\text{-}4}$	–	3	-	pF
Voltage gain					
$20 \log \frac{V_{10\text{-}4}}{V_{14\text{-}13}}$	G_{VIF}	27	30	–	dB
T_{amb} = –40 to + 85 °C	ΔG_{VIF}	–	0	–	dB
1 dB compression point (r.m.s. value)					
at V_P = 8,5 V	$V_{10\text{-}4rms}$	–	750	–	mV
at V_P = 7,5 V	$V_{10\text{-}4rms}$	–	550	–	mV
Noise figure					
at R_S = 300 Ω	NF	–	6,5	–	dB
Keyed a.g.c.					
D.C. characteristics					
Output voltage range (pin 18)	$V_{18\text{-}4}$	0,5	–	V_P–0,3	V
A.G.C. output current					
at I_3 = φ or					
$V_{12\text{-}4}$ = 450 mV; $V_{18\text{-}4}$ = $V_P/2$	$-I_{18}$	25	50	100	µA
at $V_{3\text{-}4}$ = 2 V and					
$V_{12\text{-}4}$ = 1 V; $V_{18\text{-}4}$ = $V_{15\text{-}4}$	I_{18}	2	–	5	mA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Narrowband threshold					
at V_{3-4} = 2 V; V_{12-4} = 550 mV	V_{18-4}	–	-	1	V
at V_{3-4} = 2 V; V_{12-4} = 450 mV	V_{18-4}	V_P–0,3	–	–	V
A.C. characteristics (f_i = 98 MHz)					
Input impedance					
	R_{3-4}	–	4	–	kΩ
	C_{3-4}	–	3	–	pF
Wideband threshold (r.m.s. value) (see figures 2, 3, 4 and 5)					
at V_{12-4} = 0,7 V; V_{18-4} = $V_P/2$; I_{18} = 0	$EMF2_{rms}$	–	17	–	mV
Oscillator output buffer (pin 9)					
D.C. output voltage	V_{9-4}	–	6,0	–	V
Oscillator output voltage (r.m.s. value)					
at R_L = ∞; C_L = 2 pF	$V_{9-4(rms)}$	–	110	–	mV
at R_L = 75 Ω	$V_{9-4(rms)}$	30	50	–	mV
D.C. output impedance	R_{9-15}	–	2,5	–	kΩ
Signal purity					
Total harmonic distortion	THD	–	–15	–	dBC
Spurious frequencies					
at EMF1 = 0,2 V; R_{S1} = 50 Ω	f_S	–	–35	-	dBC
Electronic standby switch (pin 11)					
Oscillator; linear i.f. amplifier; a.g.c.					
at T_{amb} = –40 to + 85 °C					
Input switching voltage					
for threshold ON; V_{18-4} = ≥ V_P–3 V	V_{11-4}	0	–	2,3	V
for threshold OFF; V_{18-4} = ≤ 0,5 V	V_{11-4}	3,3	–	23	V
Input current					
at ON condition; V_{11-4} = 0 V	$-I_{11}$	–	–	150	μA
at OFF condition; V_{11-4} = 23 V	I_{11}	–	–	10	μA
Input voltage					
at I_{11} = ϕ	V_{11-4}	–	–	4,4	V

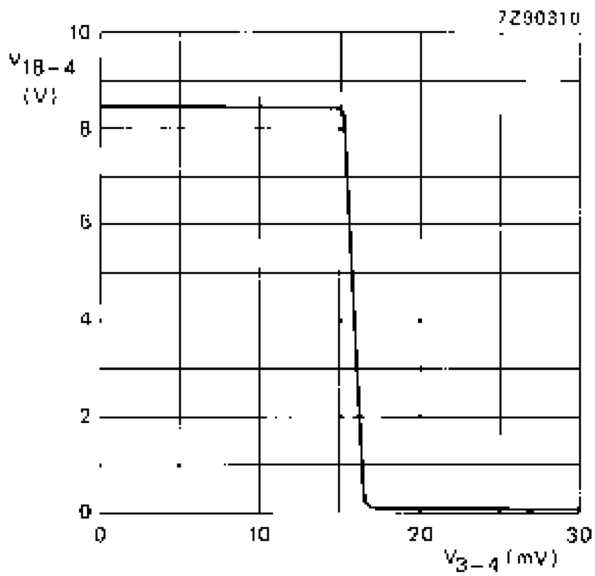


Fig. 2 Keyed a.g.c. output voltage $V_{18\text{-}4}$ as a function of r.m.s. input voltage $V_{3\text{-}4}$. Measured in test circuit Fig. 1 at $V_{12\text{-}4}$ = 0,7 V; $I_{18} = \phi$.

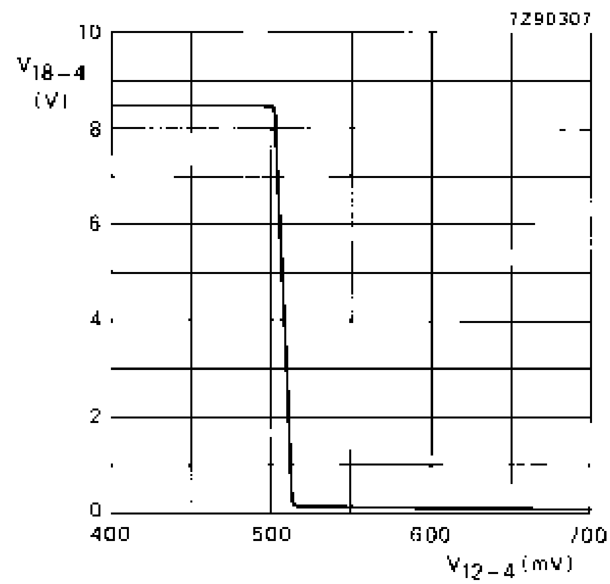


Fig. 3 Keyed a.g.c. output voltage $V_{18\text{-}4}$ as a function of input voltage $V_{12\text{-}4}$. Measured in test circuit Fig. 1 at $V_{3\text{-}4}$ = 2 V; $I_{18} = \phi$.

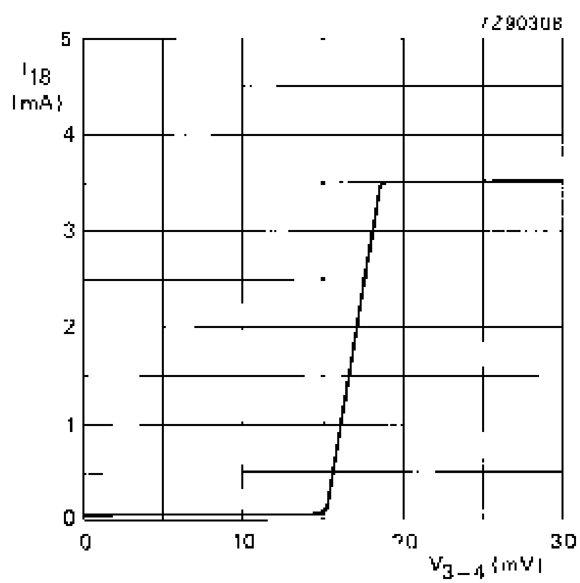


Fig. 4 Keyed a.g.c. output current I_{18} as a function of r.m.s. input voltage $V_{3\text{-}4}$. Measured in test circuit Fig. 1 at $V_{12\text{-}4}$ = 0,7 V; $V_{18\text{-}4}$ = 8,5 V.

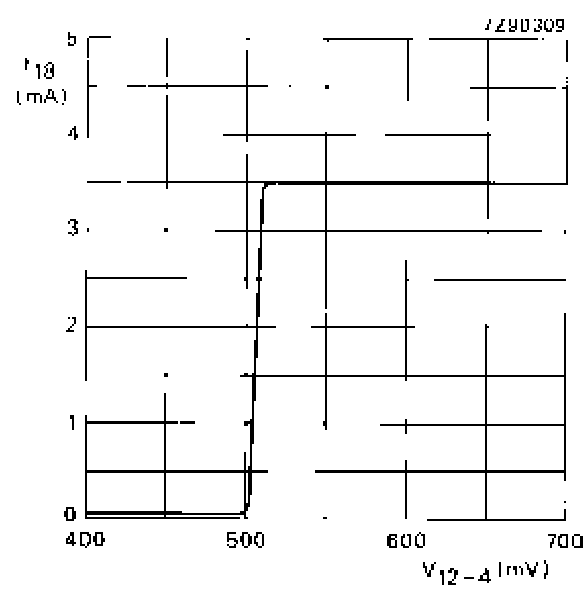
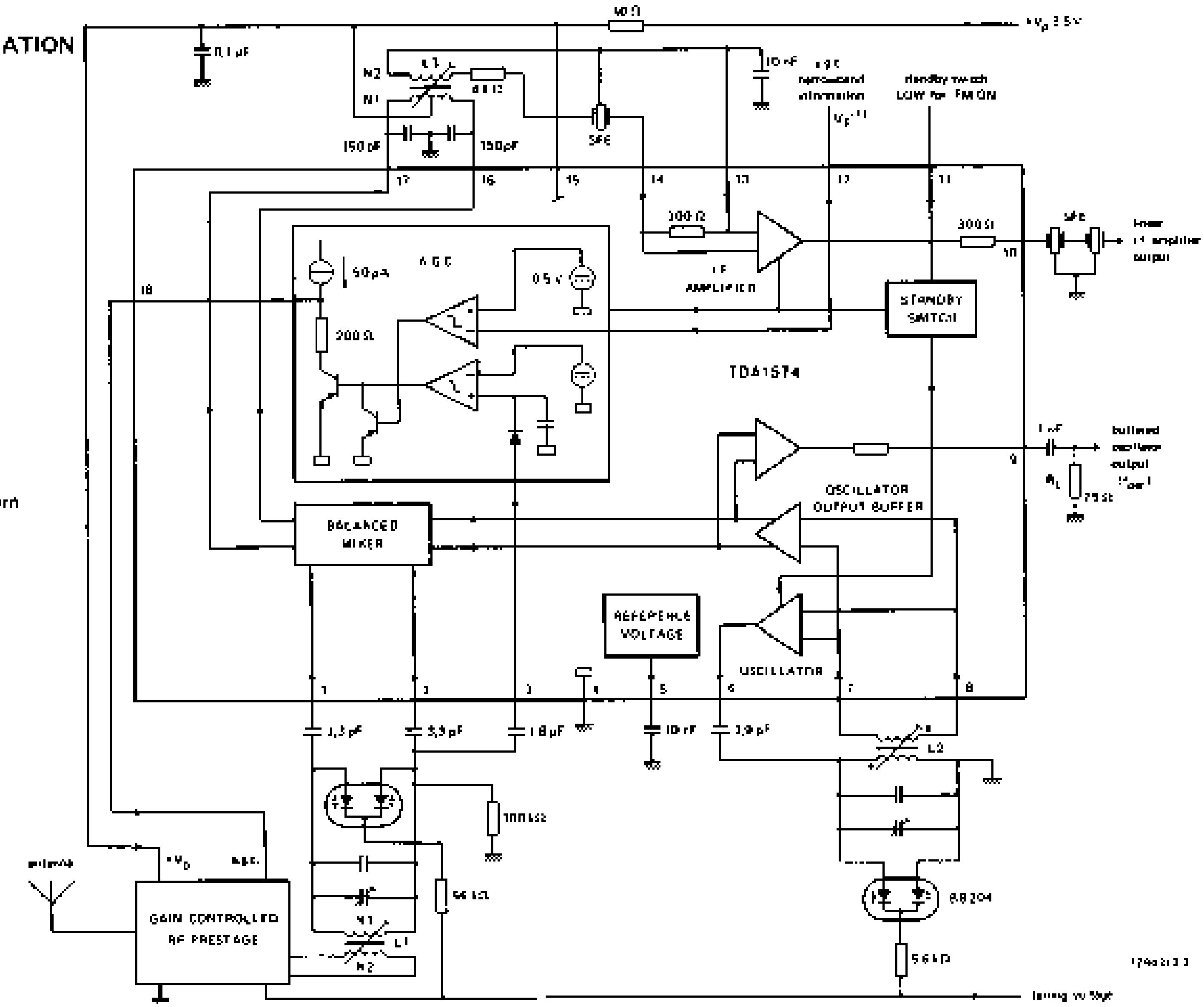


Fig. 5 Keyed a.g.c. output current I_{18} as a function of input voltage $V_{12\text{-}4}$. Measured in test circuit Fig. 1 at $V_{3\text{-}4}$ = 2 V; $V_{18\text{-}4}$ = 8,5 V.

APPLICATION INFORMATION



Coil data

L1: TOKO MC-108,
514HNE-15023515,
N1 = 5,5 turns, N2 = 1 turn

L2:
L3: see Fig. 1

(1) Field strength indication of main I.F. amplifier.